

# A new genus and species of Grapholitini (Lepidoptera, Tortricidae) from Florida, U.S.A.

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## Abstract

*Riculorampha ancyloides* Rota & Brown, **gen. n.**, **sp. n.** from Florida, is described and illustrated. The type series was reared from the fruit of redbay, *Persea borbonia* (Lauraceae). The new genus is assigned provisionally to the *Dichrorampha*-group of genera (Grapholitini) on the basis of the following characters: forewing termen with a row of black dots, forewing fringe with a shallow subapical notch, hindwing veins  $R_s$  and  $M_1$  separate and parallel or subparallel, female frenulum with two bristles, and corpus bursae with a single signum. The last character is shared with *Dichrorampha* Guenée, *Ricula* Heinrich, *Riculoides* Pas-trana, and *Goditha* Heinrich.

## Keywords

*Dichrorampha*-group, fruit-borer, genitalia, morphology, Lauraceae, *Persea*, *Riculorampha ancyloides*, wing venation

## Introduction

The tortricid tribe Grapholitini includes about 898 species assigned to 62 genera, with about 89 described species still lacking convincing generic assignments (Brown 2005). The tribe occurs worldwide but is particularly species-rich in the

Holarctic. The Neotropical and Afrotropical faunas are probably the least known, with more undescribed than described species represented in major collections worldwide (Brown pers. obs.). Grapholitines are among the most notorious lepidopterous pests of fruit, with species such as codling moth (*Cydia pomonella* (L.)), Oriental fruit moth (*Grapholita molesta* Busck), and false codling moth (*Thaumatotibia leucotreta* (Meyrick)) causing millions of dollars in damage annually. In contrast, one species of *Dichrorampha* Guenée from Jamaica has been released for biological control of a siam weed (*Chromolaena odorata* (L.) King & H.E. Robins; Asteraceae) in South Africa (Brown and Zachariades 2007). Larval biologies are diverse throughout the tribe, including gall-inducers (e.g., species of *Cydia* Hübner, *Grapholita* Treitschke, *Ecdytolopha* Zeller, *Riculoides* Pastrana) (Miller 2005), seed feeders (e.g., species of *Cydia*, *Matsumuraeses* Issiki, *Grapholita*), and fruit-feeders (e.g., species of *Gymnandrosoma* Dyar, *Cryptophlebia* Walsingham, *Thaumatotibia* Zacher). A few species are inquilines in galls of cynipid wasps (e.g., species of *Andrioplecta* Obraztsov and *Cydia latiferreana* Walsingham) (Komai 1999, Brown et al. 2008).

While a broad picture of the diversity and phylogeny of Grapholitini is beginning to emerge (e.g., Komai 1999, Horak 2006), there are still many genera and species awaiting description, and our understanding of relationships within the tribe remains preliminary. The purpose of this contribution is to describe a new genus and species of Grapholitini from southern Florida that has been reared from the fruit of redbay, *Persea borbonia* (Lauraceae) and may have been introduced from the Neotropics. We also discuss characters that may help define, or possibly broaden, the concept of the *Dichrorampha*-group of genera.

## Methods

Dissection methods follow those presented in J. Brown and Powell (1991) for genitalia and Zimmerman (1978) for wings. Forewing length is measured on a straight line from the base of the costa to the apex including the fringe. Whole specimens and genitalic slides were examined using a Leica MZ12 stereo dissecting scope under 6.5× to 40× power. Finer details of the morphology of the genitalia were examined using a Leitz Labrolux S compound microscope. Terminology follows Horak (1984) for features of the wing venation, R. Brown and Powell (1991) for elements of the forewing pattern, and Gilligan et al. (2008) for genitalic structures. Images of adults and genitalia were captured using a Visionary Digital© imaging system and enhanced using Adobe Photoshop CS© software. The holotype and three paratypes are deposited in the Florida State Collection of Arthropods (FSCA), Gainesville, FL. A male and female paratype are deposited in the collection of the National Museum of Natural History (USNM), Smithsonian Institution, Washington, D.C.

## Systematics

### *Riculatorampha*, gen. n.

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Type species: *Riculatorampha ancyloides*, sp. n.; designated by monotypy

Figs 1–6

*Riculatorampha* is provisionally assigned to the *Dichrorampha*-group of genera on the basis of the following putative synapomorphies: forewing termen with a row of black dots, forewing termen with a shallow subapical notch, hindwing veins  $R_s$  and  $M_1$  separate and parallel or subparallel, female frenulum with two bristles, and corpus bursae with a single signum. The significance of these characters is discussed below.

**Diagnosis.** Superficially, *Riculatorampha* is similar to nearly all other genera in the *Dichrorampha*-group, with a subapically “notched” termen of the forewing, a row of black dots along the forewing termen, and a two-bristled frenulum in the female. It shares with *Dichrorampha*, *Goditha* Heinrich, *Ricula* Heinrich, and *Riculoides* the loss of one of the two signa in the corpus bursae in the female genitalia. The male genitalia of *Riculatorampha* can be separated from those of *Ricula* and *Riculoides* by the reduction of socii (long and extremely slender in *Ricula* and *Riculoides*), the broad, rounded dorsum of the tegumen (narrow and attenuate dorsally in *Ricula* and *Riculoides*), and the large, triangular sacculus (smooth and rounded in *Ricula* and *Riculoides*). The last character also serves to distinguish *Riculatorampha* from *Goditha* and *Dichrorampha* and all other members of the *Dichrorampha*-group.

**Description.** *Head*: Vertex with large scale patches overlapping mediodorsally (Fig. 2); upper frons with overhanging tuft of relatively smooth scales; lower frons sparsely covered with appressed scales; ocellus relatively large, ca. 0.2× diameter of compound eye. Antenna slightly shorter than 0.5 length of forewing costa, somewhat thickened, with fine, short, dense sensory setae in both sexes. Length of labial palpus subequal to diameter of compound eye, upcurved, smooth scaled. Maxillary palpus rudimentary. *Thorax*: Dorsum smooth scaled, without posterior tuft. Legs unmodified in male. Forewing length (Fig. 1) ca. 2.0× width, forewing termen broadly bilobed, notched at vein  $M_1$ ; row of black dots along termen; discal cell length ca. 0.6× wing length; all veins present and separate (Fig. 3); chorda present, weakly defined basally.  $M$  vein well developed throughout discal cell.  $M_2$ ,  $M_3$ , and  $CuA_1$  parallel beyond discal cell and remote at termen.  $CuA_2$  originating from ca. 0.66× length of discal cell. Hindwing length ca. 1.75× width; cubital pecten absent in both sexes; female frenulum with two bristles;  $R_s$  and  $M_1$  separate, but relatively close together and parallel in basal 0.25;  $M_3$  and  $CuA_1$  connate. *Abdomen*: Male with internal glands on segment three; sternite of segment eight with Y-shaped sclerotization medially. Male genitalia (Fig. 4) with tegumen nearly parallel-sided, ca. 0.6× length of valve, rounded dorsally, expanded medially into triangular flap; no trace of uncus; socius present as short, subtriangular, hairless pad (in slide-mounted preparation of holotype, one socius hidden beneath

triangular flap of tegumen); valva elongate, upcurved, constricted at neck, narrowed apically, rounded at apex, with dense setae and spines on cucullus; basal cavity large, extending distally to neck; sacculus strongly produced apically, triangular, smooth with exception of scattered setae; microtrichiae present on outer surface of valva. Phallus curved at 0.2 from base, then straight and weakly attenuate in distal 0.8; vesica with ca. 5 slender, elongate spindle-shaped cornuti. Female genitalia (Fig. 6) with papilla analis unmodified; apophysis anterioris and posterioris subequal in length and slender, anterioris extending slightly anterad of ostium; sternite of segment eight wrinkled anterad of ostium; ductus bursae ca. 2.0× as long as abdominal segment eight, with posterior 0.5 strongly sclerotized, slightly narrowed from ostium to end of sclerotization, with rough surface texture; ductus seminalis originating at about 0.5 length of ductus bursae; ductus bursae about 1.5× wider at ostium than at junction with corpus, at junction with corpus ca. 0.25× width of corpus. Corpus bursae almost round, with rough surface texture and a single spine-shaped signum [assumed to be unmated].

**Pupa** (Based on 3 exuvia). Typically olethreutine (Fig. 5); head without apical projection; thorax and abdomen without conspicuous sculpturing; abdomen with row of small spines dorsally near middle of segments A2–A6, extending over nearly entire dorsum; slightly shorter row of larger spines near anterior edge of segments A3–A8; cremaster absent; 4 pairs of long hook-tipped setae at posterior end; pair of spines absent from anal rise.

**Etymology.** The name is a combination of *Ricula* and *Dichrorampha*, to which the genus appears to be related; it is interpreted as feminine in gender.

***Riculorampha ancyloides*, sp. n.**

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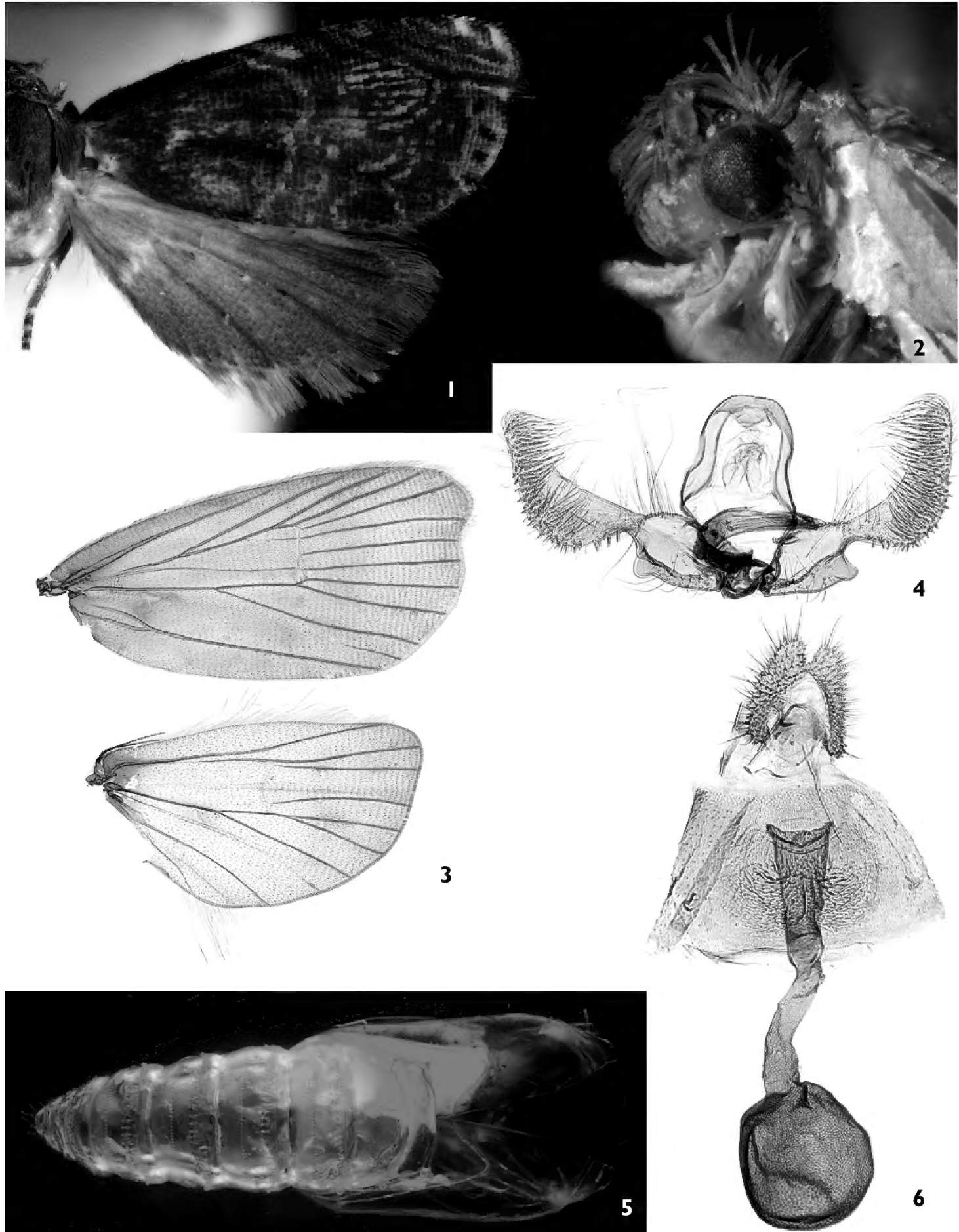
Figs 1–6

**Diagnosis.** *Riculorampha* is monotypic, with the single species *R. ancyloides*. The species can be distinguished from all other Grapholitini by its large, triangular sacculus in the male genitalia, reminiscent of that of many species of *Ancylis* Hübner (Enarmoniini).

**Description.** *Head:* Lower frons with light brown scales, upper frons with brown, somewhat iridescent scales; vertex brown. Labial palpus (Fig. 2) pale beige, distal end of segment three dark brown. *Thorax:* Dark brown dorsally, off white and shiny ventrally. Forewing length 3.5–4.5 mm (mean=4.0; n=3) in males, 4.0–5.0 mm (mean=4.7; n=3) in females. Upper side with basal ca. 0.5 dark brown, distal ca. 0.5 gray-brown, basal and distal areas separated by thin orange line (Fig. 1); an oblique violet-lead metallic streak from mid-costa towards termen bordered by orange; two oblique blue-lead metallic streaks from apical third of costa to termen; costal strigulae weakly developed except for pair 9 before apex and pair 10 at apex; short longitudinal black and orange striations just beyond discal cell; four black dots along termen within contiguous orange patch; apical notch at  $M_1$  ca. 0.25 from apex on termen denoted by a strigula of orange and white scales; fringe pale brown. Underside pale brown with me-



tallic sheen, two oblique white marks on costa before apex representing strigulae 9 and 10, strigula of yellow scales at apical notch. Hindwing length 3.0 mm in males (n=3), 3.5 mm in females (n=2); upper side pale gray brown basally, darker towards apex; fringe with brown basal portion and beige distal portion; fringe along anal edge 2–3× longer than along remainder of wing, scales extremely slender in basal 0.5, somewhat



**Figures 1–6.** *Riculorampha ancyloides*. **1** Adult female **2** Lateral view of head **3** Wing venation **4** Male genitalia **5** Pupal exuvium **6** Female genitalia.

oar-shaped in distal 0.5. Underside pale brown. *Abdomen*: Brown. Male genitalia (Fig. 4) as described for genus. Female genitalia (Fig. 6) as described for genus.

**Holotype.** ♂, USA, FLORIDA, Dade Co., Homestead, 16 Sept 1993, ex: *Persea borbonia* fruit, W. Jackson, genitalia slide USNM 119089 (FSCA).

**Paratypes.** USA, FLORIDA, Dade Co., Homestead, ex: *Persea borbonia* fruit, 28 Jul 1993 (1♂), J. Peña (FSCA); 29 Jun 1993 (1♂) (USNM), 13 Aug 1993 (1♀), R. E. Duncan and Z. Alegria (USNM); 16 Sept 1993 (1♀), W. Jackson (FSCA); 3 Sept 1993 (1♀), R. E. Duncan and Z. Alegria (FSCA).

**Distribution and biology.** *Riculorampha ancyloides* is known only from southern Florida. However, its host plant, redbay (*Persea borbonia*; Lauraceae), occurs throughout much of the southeastern U.S. and the Caribbean (USDA Plants Database 2009). It is possible that adults of this species are not attracted to light, as may be the case for other Grapholitini (e.g., *Talponia* Heinrich), and rearing infested fruits of redbay may be the best way to collect adults. Alternatively, pheromone lures could be employed, such as those for codling moth or Oriental fruit moth, which often cross-attract males of related genera. The type series of *R. ancyloides* was obtained through rearings (J. Peña, pers. comm.).

**Etymology.** The species is named for the similarity of its sacculus process of the male genitalia to that of *Ancylis*; the species epithet is an adjective in nominative singular.

**Remarks.** We examined one male from Venezuela (Aragua, Rancho Grande, 1–3 Apr 1978, J. B. Heppner, USNM) that may be conspecific with *R. ancyloides* based on its genitalia. Consequently, it is possible that *Riculorampha* has been introduced into Florida from the Neotropics.

## Discussion

Although the monophyly of Grapholitini was questioned by Horak and Brown (1991), who suggested that the tribe may represent a para- or polyphyletic assemblage of genera with similarly reduced male genitalia (e.g., *uncus* and *socii* reduced or lost), Komai (1999) presented putative synapomorphies that may define the tribe and generic groups within it. Based on the Palearctic fauna, Komai (1999) divided the tribe into three groups, the *Dichrorampha*-group, the *Cydia*-group, and the *Grapholita*-group, each defined by one or more putative synapomorphies. Horak (2006) followed Komai's (1999) assessment, adding a fourth group – the *Loranthacydia*-group.

As circumscribed by Komai (1999) and followed by Horak (2006), the *Dichrorampha*-group consists of *Dichrorampha* and *Pammenemima* Diakonoff and can be defined by the following features: hindwing veins  $R_s$  and  $M_1$  separate and parallel or subparallel; forewing with a row of dots along the termen; and sterigma, seventh sternite, and sclerotized part of ductus bursae completely fused. While Komai (1999) was unable to assign several New World genera (e.g., *Satronia* Heinrich, *Ethelgoda* Heinrich, *Talponia*, *Ricula*, *Riculoides*) to any of the three groups, some evidence suggests that these

genera may be referable to the *Dichrorampha*-group. Each possesses one or more of the synapomorphies identified by Komai, but none possesses all of them. Additional features shared by many of these genera include the forewing having a small subapical notch between  $R_5$  and  $M_1$ , female frenulum with two bristles, and corpus bursae with a single signum. While the subapical notch of the forewing and two-bristled female frenulum are found in one or more species in genera not included in the *Dichrorampha*-group (e.g., 11 of 81 species examined of *Cydia* have a predominantly two-bristled frenulum; 35 of 41 species of *Grapholita*; Rota et al. (in press)), loss of one of the signa may represent a synapomorphy for at least five genera provisionally assigned to the *Dichrorampha*-group (i.e., *Dichrorampha*, *Ricula*, *Riculoides*, *Goditha*, and *Riculorampha*). *Goditha*, *Ricula*, *Riculoides*, and *Riculorampha* also share the presence of large cornuti on the vesica and the absence of the cubital pecten. Features that are inconsistent with this assignment include presence of male paired hairpencils on segment eight in *Ricula* and *Riculoides*, which are absent in *Dichrorampha*, *Goditha*, and *Riculomorpha*; presence of a Y- or T-shaped sclerotization on the sternite of the abdominal segment eight in *Riculoides* and *Riculorampha*, that is absent in *Dichromorpha*, *Goditha*, and *Ricula*; and the shape of the tegumen, which is broad in *Dichrorampha*, *Ricula*, and *Riculomorpha*, and attenuate dorsally in *Goditha* and *Riculoides*.

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